PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

AGFA-GEVAERT N.V.
Attn.:Van Ostaeyen, Marc
Corporate IP Department
Septestraat 27
B-2640 Mortsel
BELGIQUE

Date of mailing (day/month/year)
10 July 2000 (10.07.00)

Applicant's or agent's file reference
A-G 6564-PC Jo

IMPORTANT NOTIFICATION

International application No.
PCT/EP99/05147

International filing date (day/month/year)
20 July 1999 (20.07.99)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address
AGFA-GEVAERT AG
Kaiser-Wilhelm-Allee
D-51373 Leverkusen
Germany

State of Nationality: DE
State of Residence: DE
Telephone No.:
Facsimile No.:
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [X] the name [X] the address [X] the nationality [X] the residence

Name and Address
AGFA-GEVAERT NAAMLOZE VENNOOTSCHAP
Septestraat 27
B-2640 Mortsel
Belgium

State of Nationality: BE
State of Residence: BE
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

Authorized officer
A. Karkachi
Telephone No.: (41-22) 338.83.38

Copy for the Elected Office (EO/US) PCT/EP99/05147

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

AGFA-GEVAERT N.V.
Attn.:Van Ostaeyen, Marc
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20 July 1999 (20.07.99)

1. The following indications appeared on record concerning:

[ ] the applicant [ ] the inventor [ ] the agent [X] the common representative

Name and Address
AGFA-GEVAERT AG
Kaiser-Wilhelm-Allee
D-51373 Leverkusen
Germany

State of Nationality:
State of Residence:
Telephone No.: 0214 30 71166
Facsimile No.: 0214 30 534 82
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [ ] the name [X] the address [ ] the nationality [X] the residence

Name and Address
AGFA-GEVAERT N.V.
Attn.:Van Ostaeyen, Marc
Corporate IP Department
Septestraat 27
B-2640 Mortsel
Belgium

State of Nationality:
State of Residence:
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

Authorized officer
A. Karkachi
Telephone No.: (41-22) 338.83.38

09/744722

PCT/EP99/05147

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 27 March 2000 (27.03.00)	
International application No. PCT/EP99/05147	**Applicant's or agent's file reference** A-G 6564-PC Jo
International filing date (day/month/year) 20 July 1999 (20.07.99)	**Priority date** (day/month/year) 30 July 1998 (30.07.98)
Applicant CRONE, Klaus-Peter et al	

1. The designated Office is hereby notified of its election made:

   [X] in the demand filed with the International Preliminary Examining Authority on:

   04 February 2000 (04.02.00)

   [ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

   [ ] was not

   made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer R. E. Stoffel
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

Form PCT/IB/331 (July 1992)

3190966

RDM/IP-LEV
Dr. A. Jochum
Eing.: 22. Feb. 2000
PCT

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

To:
AGFA-GEVAERT AG
Kaiser-Wilhelm-Allee
D-51373 Leverkusen
ALLEMAGNE

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

Date of mailing (day/month/year) 10 February 2000 (10.02.00)	
Applicant's or agent's file reference A-G 6564-PC Jo	**IMPORTANT NOTICE**
International application No. PCT/EP99/05147	**International filing date** (day/month/year) 20 July 1999 (20.07.99)
Priority date (day/month/year) 30 July 1998 (30.07.98)	
Applicant AGFA-GEVAERT AG et al	

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
   AU,CN,EP,IL,JP,KP,KR,US

   In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
   AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CU,CZ,DE,DK,EA,EE,ES,FI,GB,GD,GE,GH,GM,HR,HU,ID,IN,IS,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MD,MG,MK,MN,MW,MX,NO,NZ,OA,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,UA,UG,UZ,VN,YU,ZA,ZW
   The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on
   10 February 2000 (10.02.00) under No. WO 00/07250

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, **a demand for international preliminary examination** must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the **national phase**, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer J. Zahra
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

Form PCT/IB/308 (July 1998)

3084970

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No. PCT/EP 99/05147

International Filing Date 20 JUL 1999 (20.07.1999)

EUROPEAN PATENT OFFICE
PCT INTERNATIONAL APPLICATION

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired) (12 characters maximum)* A-G 6564-PC Jo

Box No. I TITLE OF INVENTION

"Method of producing solar cells"

Box No. II APPLICANT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Agfa-Gevaert AG
Kaiser-Wilhelm-Allee
D 51373 Leverkusen
DE

☐ This person is also inventor.

Telephone No.
0214 30 71166

Facsimile No.
0214 30 534 82

Teleprinter No.
85 101-265byd

State *(that is, country)* of nationality: DE

State *(that is, country)* of residence: DE

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Crone, Klaus-Peter
Im Bungert 4
D 53773 Hennef
DE

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: DE

State *(that is, country)* of residence: DE

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☐ agent ☒ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

Agfa-Gevaert AG
Kaiser-Wilhelm-Allee
D 51373 Leverkusen
DE

Telephone No.
0214 30 71166

Facsimile No.
0214 30 534 82

Teleprinter No.
85 101-265-byd

☒ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Löffelmann, Günter
Am Domberg 9
D 51515 Kürten
DE

This person is:
- [ ] applicant only
- [X] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: DE

State *(that is, country)* of residence: DE

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [X] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Modemann, Karl
Heinrich-Heine-Str. 39
D 53225 Bonn
DE

This person is:
- [ ] applicant only
- [X] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: DE

State *(that is, country)* of residence: DE

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [X] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Koch, Eberhard
Königsberger Str. 34
D 51399 Burscheid
DE

This person is:
- [ ] applicant only
- [X] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: DE

State *(that is, country)* of residence: DE

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [X] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Sauerteig, Wolfgang
Walter-Flex-Str. 1
D 51373 Leverkusen
DE

This person is:
- [ ] applicant only
- [X] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: DE

State *(that is, country)* of residence: DE

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [X] the United States of America only
- [ ] the States indicated in the Supplemental Box

- [ ] Further applicants and/or (further) inventors are indicated on another continuation sheet.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

- ☒ AP **ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ EA **Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ EP **European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ OA **OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)* + GW Guinea-Bissau

added R.1(e)p

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

- ☒ AL Albania
- ☒ AM Armenia
- ☒ AT Austria
- ☒ AU Australia
- ☒ AZ Azerbaijan
- ☒ BA Bosnia and Herzegovina
- ☒ BB Barbados
- ☒ BG Bulgaria
- ☒ BR Brazil
- ☒ BY Belarus
- ☒ CA Canada
- ☒ CH and LI Switzerland and Liechtenstein
- ☒ CN China
- ☒ CU Cuba
- ☒ CZ Czech Republic
- ☒ DE Germany
- ☒ DK Denmark
- ☒ EE Estonia
- ☒ ES Spain
- ☒ FI Finland
- ☒ GB United Kingdom
- ☒ GE Georgia
- ☒ GH Ghana
- ☒ GM Gambia
- ~~☒ GW Guinea-Bissau~~
- ☒ HR Croatia
- ☒ HU Hungary
- ☒ ID Indonesia
- ☒ IL Israel
- ☒ IS Iceland
- ☒ JP Japan
- ☒ KE Kenya
- ☒ KG Kyrgyzstan
- ☒ KP Democratic People's Republic of Korea
- ☒ KR Republic of Korea
- ☒ KZ Kazakhstan
- ☒ LC Saint Lucia
- ☒ LK Sri Lanka
- ☒ LR Liberia
- ☒ LS Lesotho
- ☒ LT Lithuania
- ☒ LU Luxembourg
- ☒ LV Latvia
- ☒ MD Republic of Moldova
- ☒ MG Madagascar
- ☒ MK The former Yugoslav Republic of Macedonia
- ☒ MN Mongolia
- ☒ MW Malawi
- ☒ MX Mexico
- ☒ NO Norway
- ☒ NZ New Zealand
- ☒ PL Poland
- ☒ PT Portugal
- ☒ RO Romania
- ☒ RU Russian Federation
- ☒ SD Sudan
- ☒ SE Sweden
- ☒ SG Singapore
- ☒ SI Slovenia
- ☒ SK Slovakia
- ☒ SL Sierra Leone
- ☒ TJ Tajikistan
- ☒ TM Turkmenistan
- ☒ TR Turkey
- ☒ TT Trinidad and Tobago
- ☒ UA Ukraine
- ☒ UG Uganda
- ☒ US United States of America
- ☒ UZ Uzbekistan
- ☒ VN Viet Nam
- ☒ YU Yugoslavia
- ☒ ZW Zimbabwe

deleted R.1(e)p

Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet: GO IN AE ZA

- ☒ ~~and all the countries which have~~
- ☒ ~~acceded to the PCT by and on the~~
- ☐ ~~filing date of this application~~

added R.1(e)p

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)*

Supplemental Box *If the Supplemental Box is not used, this sheet should not be included in the request.*

1. If, in any of the Boxes, the space is insufficient to furnish all the information, in such case, write "Continuation of Box No. ..." [indicate the number of the Box] and furnish the information in the same manner as required according to the captions of the Box in which the space was insufficient, in particular:

(i) if more than two persons are involved as applicants and/or inventors and no "continuation sheet" is available: in such case, write "Continuation of Box No. III" and indicate for each additional person the same type of information as required in Box No. III. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below;

(ii) if, in Box No. II or in any of the sub-boxes of Box No. III, the indication "the States indicated in the Supplemental Box" is checked: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the applicant(s) involved and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is applicant;

(iii) if, in Box No. II or in any of the sub-boxes of Box No. III, the inventor or the inventor/applicant is not inventor for the purposes of all designated States or for the purposes of the United States of America: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the inventor(s) and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is inventor;

(iv) if, in addition to the agent(s) indicated in Box No. IV, there are further agents: in such case, write "Continuation of Box No. IV" and indicate for each further agent the same type of information as required in Box No. IV;

(v) if, in Box No. V, the name of any State (or OAPI) is accompanied by the indication "patent of addition," or "certificate of addition," or if, in Box No. V, the name of the United States of America is accompanied by an indication "continuation" or "continuation-in-part": in such case, write "Continuation of Box No. V" and the name of each State involved (or OAPI), and after the name of each such State (or OAPI), the number of the parent title or parent application and the date of grant of the parent title or filing of the parent application;

(vi) if, in Box No. VI, there are more than three earlier applications whose priority is claimed: in such case, write "Continuation of Box No. VI" and indicate for each additional earlier application the same type of information as required in Box No. VI;

(vii) if, in Box No. VI, the earlier application is an ARIPO application: in such case, write "Continuation of Box No. VI", specify the number of the item corresponding to that earlier application and indicate at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed.

2. If, with regard to the precautionary designation statement contained in Box No. V, the applicant wishes to exclude any State(s) from the scope of that statement: in such case, write "Designation(s) excluded from precautionary designation statement" and indicate the name or two-letter code of each State so excluded.

3. If the applicant claims, in respect of any designated Office, the benefits of provisions of the national law concerning non-prejudicial disclosures or exceptions to lack of novelty: in such case, write "Statement concerning non-prejudicial disclosures or exceptions to lack of novelty" and furnish that statement below.

Continuation of Box No. IX

Box No. VI PRIORITY CLAIM ☐ Further priority claims are indicated in the Supplemental Box.

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is: national application: country	regional application:* regional Office	international application: receiving Office
item (1) (30.7.98) 30. Juli 1998	198 34 358.2	DE		
item (2)				
item (3)				

☐ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s): _____

* *Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):*

ISA /

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority):*

Date *(day/month/year)* | Number | Country *(or regional Office)*

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following **number of sheets:**

request	:	5
description (excluding sequence listing part)	:	4
claims	:	1
abstract	:	1
drawings	:	
sequence listing part of description	:	
Total number of sheets	:	11

This international application is **accompanied by** the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☒ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☒ other *(specify)*: Debit order, Demand for publication copies

Figure of the drawings which should accompany the abstract:

Language of filing of the international application:

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

AGFA-GEVAERT AG

for further signatures please see supplemental sheet 4 (will follow).

For receiving Office use only

1. Date of actual receipt of the purported international application:	20 JUL 1999 (20.07.99)	2. Drawings:	
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:		☐ received:	
4. Date of timely receipt of the required corrections under PCT Article 11(2):		☐ not received:	
5. International Searching Authority (if two or more are competent): ISA /	6. ☐ Transmittal of search copy delayed until search fee is paid.		

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

AGFA-GEVAERT N.V.
Attn.:Van Ostaeyen, Marc
Corporate IP Department
Septestraat 27
B-2640 Mortsel
BELGIQUE

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing *(day/month/year)*	03.10.2000
Applicant's or agent's file reference A-G 6564-PC Jo	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP99/05147	20/07/1999	30/07/1998

Applicant
AGFA-GEVAERT NAAMLOZE VENNOOTSCHAP et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Sinanovic, E Tel.+31 70 340-2672

Form PCT/IPEA/416 (July 1992)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
A-G 6564-PC Jo		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP99/05147	20/07/1999	30/07/1998
International Patent Classification (IPC) or national classification and IPC H01L31/18		
Applicant AGFA-GEVAERT NAAMLOZE VENNOOTSCHAP et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
04/02/2000	03.10.2000
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized officer Visentin, A Telephone No. +31 70 340 2530

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP99/05147

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-4 as originally filed

Claims, No.:

1-6 as originally filed

2. The amendments have resulted in the cancellation of:

☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-3,5
	No:	Claims	4,6
Inventive step (IS)	Yes:	Claims	1-3
	No:	Claims	4-6
Industrial applicability (IA)	Yes:	Claims	1-6
	No:	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.) In this report reference is made to the following documents, cited in the International Search Report:

D1: Patent Abstracts of Japan, Vol. 11, Nr. 286 (E-541), 16 September 1987, & JP-A-62084568

D2: Patent Abstracts of Japan, Vol. 10, Nr. 376 (E-464), 13 December 1986, & JP-A-61168271

D3: Patent Abstracts of Japan, Vol. 17, Nr. 434 (E-1412), 11 August 1993, & JP-A-5090624

The following document D4 was not cited in the International Search Report.

D4: Solar Energy Materials and Solar Cells, Vol. 43 (1996), pages 93-98

2.) The subject-matter of claim 1 meet the requirements of Art. 33(2)(3) PCT, as it is considered as new and inventive with respect to the cited state of the art.
Indeed both documents D1 and D2 disclose a method of forming a solar cell by depositing a photovoltaically active layer on a support of a polymeric organic material having a glass transition temperature of from 90°C to 200°C (see D1, abstract and figure and D2, abstract). In D2 the deposition is carried out at a substrate temperature below the glass transition temperature of the polymer.
No cited document describes a step of annealing the deposited film for a period of 0.01 to 1 s at temperatures of at least 250°C, by means of a laser having an energy from 2 to 5000 W/mm^2, so that it is considered that claim 1 is new and inventive.

3.) Also the combination of the subject-matter of claim 1 with the additional features of the dependent claims 2 and 3 is considered as new and inventive (Art. 33(2)(3) PCT.

4.) The subject-matter of independent claim 4 does not meet the requirements of Art.

33(2)(3) PCT, because it lacks novelty.
Indeed both documents D1 and D2 disclose a solar cell comprising one photovoltaically active layer on a support of a polymeric organic material having a glass transition temperature of from 90°C to 200°C (see D1, abstract and figure and D2, abstract).
Therefore all features of claim 1 are known from D1 or D2 and consequently claim 4 is not novel.

5.) The subject-matter of claim 6, dependent on claim 4, is also known from D1 (see D1, abstract and figure).
Consequently this claim cannot add anything new to the subject-matter of claim 4, on which it depends (Art. 33(2)(3) PCT).
The subject-matter of claim 5, dependent on claim 4, is known from D3 (see D3, abstract and figure).
Consequently this claim cannot add anything inventive to the subject-matter of claim 4, on which it depends (Art. 33(3) PCT).

6.) All claims 1-6 meet the requirements of industrial applicability of Art. 33(4) PCT.

Re Item VII

Certain defects in the international application

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1, D2 and D3 are not mentioned in the description, nor are these documents identified therein.

Re Item VIII

Certain observations on the international application

1.) The subject-matter of claim 1 of the application does not satisfy the requirements of Art. 6 PCT.
1.1) Indeed in claim 1 a method of coating a polymeric material with a photovoltaic active layer is disclosed, without any specifications as to the kind of deposited material. In the description only thin semiconductor layers are disclosed. For the man skilled in the photovoltaic technology thin film materials are a class of materials with well defined properties (polycrystalline, microcrystalline or amorphous structure and a thickness of

some microns), different from the thicker layers of monocrystalline devices. Following the description, page 1, lines 1-3 and the example given at page 4 the method of the invention relates only to the production of thin film semiconductor layers.
Therefore, in order for the claim to be fully supported by the description (Art. 6 PCT; PCT Preliminary Examination Guidelines, Section IV, III-6.1; PCT Gazette S-07/1998, 29 October 1998) only thin film of photovoltaically active materials should be claimed.

1.2) Moreover it appears that the claimed method could not be directly used for all kind of thin film materials known to the skilled man at the filing date of the application. Indeed considering the semiconductor material $CuInSe_2$ and related compounds (containing also the elements Ga, Al or S in the molecule) it seems that it is not possible to obtain a thin film of such material using the method of claim 1. Such a thin film deposition requires normally a selenization at high temperature and for a longer time. Referring to the teaching of document D4, a selenization at 400°C for one hour is required to form a thin film layer with the required stoichiometry (see D4, pages 93-95). For this reason a polyimide sheet was used as substrate material.
Following the PCT Guidelines, Section IV, III-6.1-III-6.4 (PCT Gazette S-07/1998, 29 October 1998) generalizations are only admitted if supported by the description and if there is no reason to suppose that the invention cannot be worked through the whole of the field claimed.

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
A-G 6564-PC Jo		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP99/05147	20/07/1999	30/07/1998
International Patent Classification (IPC) or national classification and IPC H01L31/18		
Applicant AGFA-GEVAERT NAAMLOZE VENNOOTSCHAP et al.		

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   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
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   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
04/02/2000	03.10.2000
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized officer Visentin, A Telephone No. +31 70 340 2530

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP99/05147

I. Basis of the report

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Claims, No.:

1-6 as originally filed

2. The amendments have resulted in the cancellation of:

☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims 1-3,5
	No:	Claims 4,6
Inventive step (IS)	Yes:	Claims 1-3
	No:	Claims 4-6
Industrial applicability (IA)	Yes:	Claims 1-6
	No:	Claims

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.) In this report reference is made to the following documents, cited in the International Search Report:

D1: Patent Abstracts of Japan, Vol. 11, Nr. 286 (E-541), 16 September 1987, & JP-A-62084568

D2: Patent Abstracts of Japan, Vol. 10, Nr. 376 (E-464), 13 December 1986, & JP-A-61168271

D3: Patent Abstracts of Japan, Vol. 17, Nr. 434 (E-1412), 11 August 1993, & JP-A-5090624

The following document D4 was not cited in the International Search Report.

D4: Solar Energy Materials and Solar Cells, Vol. 43 (1996), pages 93-98

2.) The subject-matter of claim 1 meet the requirements of Art. 33(2)(3) PCT, as it is considered as new and inventive with respect to the cited state of the art.
Indeed both documents D1 and D2 disclose a method of forming a solar cell by depositing a photovoltaically active layer on a support of a polymeric organic material having a glass transition temperature of from 90°C to 200°C (see D1, abstract and figure and D2, abstract). In D2 the deposition is carried out at a substrate temperature below the glass transition temperature of the polymer.
No cited document describes a step of annealing the deposited film for a period of 0.01 to 1 s at temperatures of at least 250°C, by means of a laser having an energy from 2 to 5000 W/mm^2, so that it is considered that claim 1 is new and inventive.

3.) Also the combination of the subject-matter of claim 1 with the additional features of the dependent claims 2 and 3 is considered as new and inventive (Art. 33(2)(3) PCT.

4.) The subject-matter of independent claim 4 does not meet the requirements of Art.

33(2)(3) PCT, because it lacks novelty.
Indeed both documents D1 and D2 disclose a solar cell comprising one photovoltaically active layer on a support of a polymeric organic material having a glass transition temperature of from 90°C to 200°C (see D1, abstract and figure and D2, abstract).
Therefore all features of claim 1 are known from D1 or D2 and consequently claim 4 is not novel.

5.) The subject-matter of claim 6, dependent on claim 4, is also known from D1 (see D1, abstract and figure).
Consequently this claim cannot add anything new to the subject-matter of claim 4, on which it depends (Art. 33(2)(3) PCT).
The subject-matter of claim 5, dependent on claim 4, is known from D3 (see D3, abstract and figure).
Consequently this claim cannot add anything inventive to the subject-matter of claim 4, on which it depends (Art. 33(3) PCT).

6.) All claims 1-6 meet the requirements of industrial applicability of Art. 33(4) PCT.

Re Item VII

Certain defects in the international application

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1, D2 and D3 are not mentioned in the description, nor are these documents identified therein.

Re Item VIII

Certain observations on the international application

1.) The subject-matter of claim 1 of the application does not satisfy the requirements of Art. 6 PCT.
1.1) Indeed in claim 1 a method of coating a polymeric material with a photovoltaic active layer is disclosed, without any specifications as to the kind of deposited material. In the description only thin semiconductor layers are disclosed. For the man skilled in the photovoltaic technology thin film materials are a class of materials with well defined properties (polycrystalline, microcrystalline or amorphous structure and a thickness of

some microns), different from the thicker layers of monocrystalline devices. Following the description, page 1, lines 1-3 and the example given at page 4 the method of the invention relates only to the production of thin film semiconductor layers.
Therefore, in order for the claim to be fully supported by the description (Art. 6 PCT; PCT Preliminary Examination Guidelines, Section IV, III-6.1; PCT Gazette S-07/1998, 29 October 1998) only thin film of photovoltaically active materials should be claimed.

1.2) Moreover it appears that the claimed method could not be directly used for all kind of thin film materials known to the skilled man at the filing date of the application. Indeed considering the semiconductor material $CuInSe_2$ and related compounds (containing also the elements Ga, Al or S in the molecule) it seems that it is not possible to obtain a thin film of such material using the method of claim 1. Such a thin film deposition requires normally a selenization at high temperature and for a longer time. Referring to the teaching of document D4, a selenization at 400°C for one hour is required to form a thin film layer with the required stoichiometry (see D4, pages 93-95). For this reason a polyimide sheet was used as substrate material.
Following the PCT Guidelines, Section IV, III-6.1-III-6.4 (PCT Gazette S-07/1998, 29 October 1998) generalizations are only admitted if supported by the description and if there is no reason to suppose that the invention cannot be worked through the whole of the field claimed.

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : H01L 31/18, 31/0392

A1

(11) International Publication Number: **WO 00/07250**

(43) International Publication Date: 10 February 2000 (10.02.00)

(21) International Application Number: PCT/EP99/05147

(22) International Filing Date: 20 July 1999 (20.07.99)

(30) Priority Data:
198 34 358.2 30 July 1998 (30.07.98) DE

(71) Applicant *(for all designated States except US)*: AGFA-GEVAERT AG [DE/DE]; Kaiser-Wilhelm-Allee, D-51373 Leverkusen (DE).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: CRONE, Klaus-Peter [DE/DE]; Im Bungert 4, D-53773 Hennef (DE). LÖFFELMANN, Günter [DE/DE]; Am Domberg 9, D-51515 Kürten (DE). MODEMANN, Karl [DE/DE]; Heinrich-Heine-Strasse 39, D-53225 Bonn (DE). KOCH, Eberhard [DE/DE]; Königsberger Strasse 34, D-51399 Burscheid (DE). SAUERTEIG, Wolfgang [DE/DE]; Walter-Flex-Strasse 1, D-51373 Leverkusen (DE).

(74) Common Representative: AGFA-GEVAERT AG; Kaiser-Wilhelm-Allee, D-51373 Leverkusen (DE).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: METHOD OF PRODUCING SOLAR CELLS

(57) Abstract

Organic polymeric films may serve as supporting materials for at least one photovoltaically active layer, if the supporting material consists of a polymeric material with a glass transition temperature of from 90 °C to 200 °C. The coating of the photovoltaically active layer is carried out at temperatures below the glass transition temperature and annealing is carried out at temperatures of at least 250° by means of a laser.

INTERNATIONAL SEARCH REPORT

Intern. al Application No
PCT/EP 99/05147

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01L31/18 H01L31/0392

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	HAILIN HU ET AL: "CHEMICAL DEPOSITION OF PHOTOSENSITIVE CDS THIN FILMS ON POLYESTER FOILS" JOURNAL OF CRYSTAL GROWTH,NL,NORTH-HOLLAND PUBLISHING CO. AMSTERDAM, vol. 152, no. 3, page 150-157 XP000626678 ISSN: 0022-0248 the whole document ---	1,2
X	PATENT ABSTRACTS OF JAPAN vol. 011, no. 286 (E-541), 16 September 1987 (1987-09-16) & JP 62 084568 A (TEIJIN LTD), 18 April 1987 (1987-04-18) abstract --- -/--	4,6

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 November 1999	22/11/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Visentin, A

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Interna al Application No
PCT/EP 99/05147

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 010, no. 376 (E-464), 13 December 1986 (1986-12-13) & JP 61 168271 A (SUMITOMO BAKELITE CO LTD;OTHERS: 01), 29 July 1986 (1986-07-29) abstract	4
A	PATENT ABSTRACTS OF JAPAN vol. 008, no. 036 (E-227), 16 February 1984 (1984-02-16) & JP 58 194377 A (KOGYO GIJUTSUIN;OTHERS: 0J), 12 November 1983 (1983-11-12) abstract	1-4,6
A	PATENT ABSTRACTS OF JAPAN vol. 017, no. 434 (E-1412), 11 August 1993 (1993-08-11) & JP 05 090624 A (NISSHA PRINTING CO LTD), 9 April 1993 (1993-04-09) abstract	1,3-6
A	US 5 304 499 A (BONNET DIETER ET AL) 19 April 1994 (1994-04-19) cited in the application	
A	NISHIWAKI H ET AL: "DEVELOPMENT OF AN ULTRALIGHT, FLEXIBLE A-SI SOLAR CELL SUBMODULE", SOLAR ENERGY MATERIALS AND SOLAR CELLS,NL,ELSEVIER SCIENCE PUBLISHERS, AMSTERDAM, VOL. 37, NR. 3/04, PAGE(S) 295-306 XP000521870 ISSN: 0927-0248 cited in the application	

INTERNATIONAL SEARCH REPORT

Information on patent family members

Internal Application No
PCT/EP 99/05147

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 62084568 A	18-04-1987	JP 1946831 C	10-07-1995
		JP 6071091 B	07-09-1994
JP 61168271 A	29-07-1986	NONE	
JP 58194377 A	12-11-1983	JP 1692887 C	17-09-1992
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US 5304499 A	19-04-1994	DE 4132882 A	29-04-1993
		DE 59207710 D	30-01-1997
		EP 0535522 A	07-04-1993
		ES 2097249 T	01-04-1997
		HK 1007631 A	16-04-1999
		JP 6045626 A	18-02-1994

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : H01L 31/18, 31/0392

A1

(11) International Publication Number: **WO 00/07250**

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(74) Common Representative: AGFA–GEVAERT AG; Kaiser–Wilhelm–Allee, D–51373 Leverkusen (DE).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: METHOD OF PRODUCING SOLAR CELLS

(57) Abstract

Organic polymeric films may serve as supporting materials for at least one photovoltaically active layer, if the supporting material consists of a polymeric material with a glass transition temperature of from 90 °C to 200 °C. The coating of the photovoltaically active layer is carried out at temperatures below the glass transition temperature and annealing is carried out at temperatures of at least 250° by means of a laser.

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BY	Belarus
CA	Canada
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Côte d'Ivoire
CM	Cameroon
CN	China
CU	Cuba
CZ	Czech Republic
DE	Germany
DK	Denmark
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Method of producing solar cells

The invention relates to an economically improved method of producing thin-layer solar cells, e.g. CdTe solar cells (CdTe = cadmium telluride). CdTe is used below merely as an example for all thin-layer solar cells.

CdTe and CdTe/CdS solar cells may be produced by various methods (US-5 304 499), common to all of which is heat treatment at at least 575°C, to achieve adequate efficiency. These temperatures allow the use only of expensive types of glass as supports. The use of glass as a support has the disadvantage that glass panels may be coated with CdTe only in discontinuous manner, irrespective of the coating method selected.

US-5 304 499 describes a method in which coating is carried out at temperatures of only 480 to 520°C, it thus being possible to use cheap types of glass ("window glass").

To this end, it is necessary for the glass firstly to be provided with a transparent, electrically conductive layer, e.g. of doped tin oxide. This is followed by a thin cadmium sulfide layer (CdS), to which the light-sensitive CdTe layer is then applied by sublimation at 480 to 520°C.

The apparatus required for application of the CdTe layer is complex and expensive: support material and CdTe source are held in such a way by opposing graphite blocks, which are heated to the necessary temperature, that the CdTe source is located only 2 to 3 mm from the support surface. Sublimation is then effected in a 0.1 mbar inert gas atmosphere, e.g. a nitrogen, helium, argon or hydrogen atmosphere. Large areas of CdTe-coated material for producing solar cells cannot be produced economically in this way.

H. Nishiwaki et al, Solar Energy Materials and Solar Cells 37 (1995) 295 to 306 use a polyimide film as support because this material has sufficient heat resistance in

comparison to polyethylene terephthalate (PET) and polyethylene naphthalate (PEN), because of its glass transition temperature of more than 500°C. Polyimide has the disadvantage to be insoluble in usual solvents and to be unable to be molten. It is therefore extremely difficult to be processed.

The known methods do not permit the use of easily produceable films of polymeric organic materials as supports.

The object of the invention was the economic production of a support with a photovoltaically active layer, e.g. a CdTe layer.

A method was surprisingly found, which permits the use of flexible polymeric films for coating with CdTe and annealing, without the polymeric supporting material being damaged by the high temperatures. In this way, a starting material is obtained for high efficiency solar cells.

The invention therefore provides a method of coating organic polymeric supporting materials with CdTe and annealing the CdTe layer of the materials thus coated, characterised in that the supporting material consists of a polymeric material with a glass transition temperature of from 90°C to 200°C and coating of the CdTe layer is carried out at temperatures below the glass transition temperature and annealing at temperatures of at least 250°C, in particular 400 to 600°C, by means of a laser for 0.01 to 1 s with an energy of 2 to 5000 watt per mm^2.

Preferably the supporting material is at least 60 µm, in particular 90 to 120 µm, thick and the CdTe layer is at most 30 µm, in particular 2 to 7 µm, thick.

Coating is carried out for example with an aqueous or solvent-containing CdTe suspension.

The material is then dried. Suitable coating methods are, for example, flooding and knife coating.

Annealing may be carried out several times; cooling phases are preferably provided between pairs of annealing steps.

Suitable polymers are PET and PEN. Prior to coating, the polymeric supporting material may be provided with a substrate layer, e.g. of indium-tin oxide, which improves the adhesion of the CdTe layer. The substrate layer should be transparent and electrically conductive.

Suitable lasers are, for example, argon lasers and yag lasers with frequency duplication.

Organic polymeric supporting materials are flexible and thus permit continuous coating using a suitable coating method.

It is especially advantageous for the CdTe particles to be particularly fine, in particular in the form of so-called nano-particles, i.e. particles whose average diameter lies in the nanometric range and amounts, for example, to from 3 to 5 nm.

In this case, it is expedient for an agent to be present during production of the nanoparticles which prevents agglomeration of the nanoparticles, e.g. tributyl-phosphane.

The invention also provides a solar cell comprising at least one CdTe layer at most 30 µm thick on a support, characterised in that the support is a polymeric organic material at least 60 µm thick and having a glass transition temperature of at least 90°C.

Owing to its flexibility, the polymeric organic support permits continuous coating by means of a coater, for example a meniscus or curtain coater, as known from the coating of photographic films.

Example

A film of PEN 100 µm thick and 100 cm wide is coated continuously with a suspension containing a dispersant and 31 g of cadmium telluride per litre. The coated film is then dried and the layer applied exhibits a dry layer thickness of 5 µm.

The film is annealed as follows:

The entire surface is irradiated with an Ar ion laser (wavelength 514 nm; power 7 W) with a focal point of 50 µm. The temperature is adjusted at from 400 to 450°C.

After annealing, the film exhibits light-dependent electrical resistance and is thus suitable for the production of a photovoltaic cell.

The supporting material is not damaged by exposure to the laser.

Claims

1. A method of coating organic polymeric supporting materials with at least one photovoltaically active layer and annealing the materials thus coated, characterised in that the supporting material consists of a polymeric material with a glass transition temperature of from 90°Cto 200°C. Coating is carried out at temperatures below the glass transition temperature and annealing at temperatures of at least 250°, in particular 400 to 600°C, by means of a laser for 0.01 to 1 s with an energy to 2 to 5000 watt per mm^2.

2. A method according to claim 1, wherein the supporting material is at least 60 µm thick and the photovoltaic layer is at most 30 µm thick.

3. A method according to claim 1, wherein the supporting material is of polyethylene terephthalate or polyethylene naphthalate.

4. A solar cell comprising at least one photovoltaically active layer on a support, characterised in that the support is a polymeric organic material having a glass transition temperature of from 90°C to 200°C.

5. A solar cell, according to claim 4, characterised in that the photovoltaically active layer comprises cadmium telluride.

6. A solar cell according to claim 4, characterised in that the support consists of polyethylene terephthalate or polyethylene naphthalate.

INTERNATIONAL SEARCH REPORT

Intern. al Application No
PCT/EP 99/05147

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01L31/18 H01L31/0392

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	HAILIN HU ET AL: "CHEMICAL DEPOSITION OF PHOTOSENSITIVE CDS THIN FILMS ON POLYESTER FOILS" JOURNAL OF CRYSTAL GROWTH,NL,NORTH-HOLLAND PUBLISHING CO. AMSTERDAM, vol. 152, no. 3, page 150-157 XP000626678 ISSN: 0022-0248 the whole document ---	1,2
X	PATENT ABSTRACTS OF JAPAN vol. 011, no. 286 (E-541), 16 September 1987 (1987-09-16) & JP 62 084568 A (TEIJIN LTD), 18 April 1987 (1987-04-18) abstract --- -/--	4,6

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
11 November 1999	22/11/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Visentin, A

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INTERNATIONAL SEARCH REPORT

Interna al Application No
PCT/EP 99/05147

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 010, no. 376 (E-464), 13 December 1986 (1986-12-13) & JP 61 168271 A (SUMITOMO BAKELITE CO LTD;OTHERS: 01), 29 July 1986 (1986-07-29) abstract	4
A	PATENT ABSTRACTS OF JAPAN vol. 008, no. 036 (E-227), 16 February 1984 (1984-02-16) & JP 58 194377 A (KOGYO GIJUTSUIN;OTHERS: 0J), 12 November 1983 (1983-11-12) abstract	1-4,6
A	PATENT ABSTRACTS OF JAPAN vol. 017, no. 434 (E-1412), 11 August 1993 (1993-08-11) & JP 05 090624 A (NISSHA PRINTING CO LTD), 9 April 1993 (1993-04-09) abstract	1,3-6
A	US 5 304 499 A (BONNET DIETER ET AL) 19 April 1994 (1994-04-19) cited in the application	
A	NISHIWAKI H ET AL: "DEVELOPMENT OF AN ULTRALIGHT, FLEXIBLE A-SI SOLAR CELL SUBMODULE" , SOLAR ENERGY MATERIALS AND SOLAR CELLS,NL,ELSEVIER SCIENCE PUBLISHERS, AMSTERDAM, VOL. 37, NR. 3/04, PAGE(S) 295-306 XP000521870 ISSN: 0927-0248 cited in the application	

INTERNATIONAL SEARCH REPORT

Information on patent family members

Internat al Application No
PCT/EP 99/05147

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 62084568 A	18-04-1987	JP 1946831 C	10-07-1995
		JP 6071091 B	07-09-1994
JP 61168271 A	29-07-1986	NONE	
JP 58194377 A	12-11-1983	JP 1692887 C	17-09-1992
		JP 3070388 B	07-11-1991
JP 05090624 A	09-04-1993	NONE	
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		DE 59207710 D	30-01-1997
		EP 0535522 A	07-04-1993
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		HK 1007631 A	16-04-1999
		JP 6045626 A	18-02-1994

PATENT COOPERATION TREATY

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION** see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
A-G 6564-PC Jo		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/EP 99/ 05147	20/07/1999	30/07/1998
Applicant		
AGFA-GEVAERT AG et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. --

   [ ] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [ ] None of the figures.

INTERNATIONAL SEARCH REPORT

National Application No
PCT/EP 99/05147

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01L31/18 H01L31/0392

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 November 1999	22/11/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Visentin, A

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
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		JP 6071091 B	07-09-1994
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JP 58194377 A	12-11-1983	JP 1692887 C	17-09-1992
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